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RESIST SPREADER

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RESIST SPREADER

[Rejisuto tofu shochi]

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[There are no amendments to this patent.]

Claims

1. A resist spreader, characterized by the fact that in a resist spreader having a substrate holder for vacuum-absorbing a semiconductor wafer, it is equipped with a washing head part having a brush for washing the above-mentioned substrate holder and a jet port for jetting a washing solution and a gas; a washing arm being connected to the above-mentioned washing head part; a driving part for moving the above-mentioned washing arm in the vertical direction and the horizontal direction; and an automatic spin chuck washer having a control part for a jet control of the above-mentioned washing solution, a jet control of the above-mentioned gas, and a driving control of the above-mentioned driving part.

2. The resist spreader of Claim 1, characterized by the fact that the above-mentioned brush is a brush composed of fibers made of fluororesin.

3. The resist spreader of Claim 1, characterized by the fact that the above-mentioned washing solution is acetone.

4. The resist spreader of Claim 1, characterized by the fact that the above-mentioned gas is one of air and N_2 gas.

Detailed explanation of the invention

[0001]

Technical field of the invention

The present invention pertains to a resist spreader. More specifically, the present invention pertains to a resist spreader with an automatic washing mechanism of a spin chuck for vacuum-adsorbing a semiconductor wafer to a spin-coating part.

[0002]

Prior art

In a resist spreader being used in the manufacturing processes of a semiconductor device, a photoresist is spread on a semiconductor wafer by using a so-called spin-coating method that places a semiconductor wafer in a substrate holder, so-called spin chuck, absorbs the semiconductor wafer by a vacuum absorption (vacuum chuck), drops a photoresist, rotates the spin chuck at high speed, expand the photoresist by a centrifugal force, and uniformly spreads the photoresist on the entire surface of the semiconductor wafer.

[0003]

A general resist spreader is used by being connected with an exposure system, and semiconductor wafers before spreading a resist are carried by a wafer carriage system from a wafer carrier of a loading part being loaded with a wafer carrier in which many semiconductor wafers are housed, sent to a spin-coating method, sent to a prebaking part of the photoresist from the spin-coating method, and sent to the exposure system from the prebaking part. A conventional example of the spin-coating method in the resist spreader is explained referring to Figures 3 and 4.

[0004]

A spin-coating method of the resist spreader, as shown in Figure 3, is roughly constituted by a spin chuck 11 of the spin-coating part 1 which vacuum-chucks a semiconductor wafer 10 and is rotated by a motor 13, a rotational shaft 12 connected with the spin chuck 11, a motor 13,

an exhaust pump 14 for vacuum-chucking the semiconductor wafer 10, a cup 15 which is installed at the outer peripheral part of the spin chuck 11 and receives photoresists being flown by a centrifugal force, and a photoresist nozzle 16 being moved to the central upper part of the semiconductor wafer 10 when the photoresist is dropped on the semiconductor wafer 10.

[0005]

In the surface structure of the spin chuck 11, as shown in Figure 4, circular vacuum chuck groove parts 11b and a cross-shaped vacuum chuck groove part 11c intersecting with the vacuum chuck groove parts 11b are installed, and the center of the cross-shaped vacuum chuck groove part 11c is connected with an exhaust hole 11a of the central part of the spin chuck 11. The vacuum chuck of the semiconductor wafer 10 to the spin chuck 11 is carried out by the exhaust of an exhaust pump 14 through an exhaust hole 11a at the center part of the spin chuck 11 connected to the vacuum chuck groove parts 11b installed on the surface of the spin chuck 11, an exhaust hole 12a of the rotational shaft 12, an exhaust hole 17a of a vacuum chuck 17 mounted around the rotational shaft 12 so that the rotation of the rotational shaft 12, and an exhaust pipe 18, after a valve 19 installed in the middle of an exhaust pipe 18, is opened.

[0006]

At the bottom of the cup 15, a wafer solution pipe 20 which gathers and discharges the flown photoresists and an exhaust pipe 21 of an exhaust system which sends the atmosphere in the vicinity of the semiconductor wafer 10 downward to prevent the resists and particulates of a rinsing solution floating in the atmosphere in the vicinity of the semiconductor wafer 10 from being reattached to the semiconductor wafer 10 are installed.

[0007]

The nozzle 16 existing above the semiconductor wafer 10 is connected to a valve 22 for controlling the amount of photoresist being dropped via a pipe 23 for photoresist, and a suck back part 24 which returns the photoresist of the tip of the photoresist nozzle 16 to the supply side after dropping the photoresist on the semiconductor wafer 10 and prevents the flop drop of the photoresist on the semiconductor wafer 10 is connected to the site branched from the middle of the pipe 23.

[0008]

In the spreading operation of the photoresist in the spin-coating part of the above-mentioned resist spreader, first, the semiconductor water 10 is carried by a carriage system (not shown in the figure) of the resist spreader and placed on the spin chuck 11. Next, the

valve 19 of the exhaust pipe 18 is opened, and the semiconductor wafer 10 is vacuum-chucked in the spin chuck 11. Then, the photoresist nozzle 16 connected to the pipe 23 is moved in the horizontal direction by a driving part (not shown in the figure) and installed above the central part of the semiconductor wafer 10. Then, the valve 22 is opened for a prescribed time, and a prescribed amount of photoresist is dropped on the central part of the semiconductor wafer 10 from the tip of the photoresist nozzle 16. After dropping the photoresist, the sack back part 24 is automatically operated, and the photoresist of the tip of the photoresist nozzle 16 is returned to the supply side. Then, the photoresist nozzle 16 is moved in the horizontal direction by a driving part (not shown in the figure) and returned to the original position from the position above the center part of the semiconductor wafer 10.

[0009]

Next, the spin chuck 11 is rotated by the motor 13, the photoresist with a nearly uniform prescribed film thickness is spread on the semiconductor wafer 10, and the rotation of the spin chuck 11 is stopped. Then, the valve 19 of the exhaust pipe 18 is closed, and the vacuum chuck of the spin chuck 11 of the semiconductor wafer 10 is released. Furthermore, the semiconductor wafer on which the photoresist is spread is carried to the prebaking part from the spin-coating part 1 by the carriage system (not shown in the figure) of the resist spreader, and after prebaking, the semiconductor wafer is sent to an exposure system by the carriage system.

[0010]

When the semiconductor wafer 10 is vacuum-chucked in the spin chuck 11 of the above-mentioned spin-coating part 1, if dusts or photoresists are attached to the surface of the spin chuck 11, the vacuum chuck of the semiconductor wafer 10 is incomplete, and the spin chuck 11 is rotated, so that the semiconductor wafer 10 is separated from the spin chuck 11, thereby damaging the semiconductor wafer 10 or contaminating the semiconductor wafer 10 due to the contact with the cup 15. Also, if dusts are solid, when the semiconductor wafer 10 is vacuum-chucked, the semiconductor wafer 10 is likely to be split. Furthermore, if the photoresists attached to the surface of the spin chuck 11 are attached in a transferred shape to the back face of the semiconductor wafer 10, the photoresists are attached to a carriage belt in case the carriage system of the bent carriage is used, so that the carriage system is troubled or the carriage system, etc., of the exposure system connected to the resist spreader are troubled. Also, the contaminants to the back face of the semiconductor 10 from the surface of the spin chuck 11 are diffused into the semiconductor wafer 10 in the postprocess, and the manufacture yield of semiconductor devices is lowered. In order to suppress the generation of the above-mentioned

problems, a method that removes the spin chuck 11 from the spin-coating part 1 and washes the spin chuck 11 has been adopted, however the operability of the resist spreader is lowered.

[0011]

Problems to be solved by the invention

The purpose of the present invention is to solve the problems in the above-mentioned semiconductor manufacturing apparatus. In other words, the purpose of the present invention is to provide a resist spreader in which the operability decrease due to washing of the spin chuck for vacuum-chucking a semiconductor wafer is suppressed.

[0012]

Means to solve the problems

The resist spreader of the present invention is proposed to solve the above-mentioned problems and is characterized by the fact that in the resist spreader having a substrate holder for vacuum-absorbing a semiconductor wafer, it is equipped with a washing head part having a brush for washing the substrate holder and a jet port for jetting a washing solution and a gas; a washing arm being connected to the washing head part; a driving part for moving the washing arm in the vertical direction and the horizontal direction; and an automatic spin chuck washer having a control part for a jet control of the washing solution, a jet control of the gas, and a driving control of the driving part.

[0013]

According to the present invention, since the spin chuck washing of the above-mentioned automatic spin chuck washer, which washes the spin chuck of the resist spreader, can be automatically carried out, it is not necessary to wash the spin chuck after removing the spin chuck from the spin-coating part, unlike the conventional method. Therefore, if the spin chuck is periodically washed by the above-mentioned automatic spin chuck washing means, the semiconductor wafer damage during spreading of the photoresist, which is caused by the inferiority of the vacuum chuck due to the dusts of the spin chuck surface and the photoresists attached to the spin chuck surface, can be lightened, and the decrease of the manufacture yield of semiconductor devices due to the dust attachment in the spin chuck part to the back face of the semiconductor wafer can be reduced.

[0014]

Embodiment of the invention

Next, a detailed embodiment of the present invention is explained referring to the attached figures. Also, the same reference symbols are given to constitutional parts similar to the constitutional parts in Figures 3 and 4 referred in the explanation of the prior art.

[0015]

In this embodiment, the present invention is applied to a resist spreader having a substrate holder for vacuum-chucking a semiconductor wafer, and it is explained referring to Figures 1 and 2. Here, Figure 1 is an outline diagram showing a spin-coating part 1 of the resist spreader, and Figure 2 is an outline diagram showing a washing head part 51 of an automatic spin chuck washer 50. Figure 2(a) is an outlined diagram showing the washing head part 51, and Figure 2(b) is an outlined plan view showing the washing head part 51 observed from the lower side. First, since the basic constitution of the spin-coating part 1 of the resist spreader, as shown in Figure 1, is almost similar to the spin-coating part 1 of the resist spreader of the conventional example, the explanation of similar parts is omitted, and the explanation of characteristic parts is mentioned in detail.

[0016]

An exhaust system for vacuum-chucking a semiconductor wafer placed on the spin chuck 11 consists of exhaust hole 11a of the spin chuck 11, exhaust hole 12a of a rotational shaft 12, exhaust hole 17a of a vacuum chuck 17, exhaust pipe 18, valve 19, and exhaust pump 14. A pipe 31 for discharging a gas such as N_2 gas to the upper side from the exhaust hole 11a of the spin chuck 11 when washing the surface of the spin chuck 11 is connected to the exhaust pipe 18 between the exhaust hole 17a of the exhaust system and the valve 19, and a valve 30 is installed in the middle of the pipe 31.

[0017]

An automatic spin chuck washer 50 for washing the spin chuck 11 roughly consists of washing head part 51, washing arm part 52 being connected to the washing head part 51, driving part 53 for rotating the washing arm part 52 in the vertical direction and the horizontal direction, and control part 54 for the jet control of a washing solution, the jet control of a gas, and the driving control of the driving part. A pipe 55 for sending a washing solution such as acetone for dissolving photoresists from a washing solution supply part (omitted in the figure) is connected to the washing head part 51, and a valve 56 being controlled by the control part 54 is installed in the middle of the pipe 55. Also, a pipe 57 for feeding a gas such as N_2 gas into the washing head

part 51 is installed by connecting to the pipe 55 between the washing head part 51 and the valve 56, and a valve 58 being controlled by the control part 54 is installed in the middle of the pipe 57.

[0018]

The washing head part 51, as shown in Figures 2(a) and 2(b), consists of rectangular parallelepiped jet part 51b having a hollow part with a long side slightly larger than the radius of the spin chuck 11,brush 51a composed of fibers made of a fluororesin for washing installed in the jet part 51b, for example, a brush composed of fibers made of Teflon, and pipe part 51c being connected with the pipe 55 to which a washing solution or N_2 gas is sent. In the rectangular parallelepiped jet part 51b, as shown in Figure 2(b), the brush 51a for washing of the jet part 51b is installed along the long side of the jet part 51b, and several jet ports 51d with a small diagram are installed parallel with the brush 51a for washing. Also, when the rotating direction of the spin chuck 11 below the washing head part 51, for example, the rotating direction of the arrow C shown in Figure 2(b) is set, the position relation between the jet part 51b and the brush 51a is in order of the jet part 51b and the brush 51a in the arrow C direction.

[0019]

The washing arm 52 supports the washing head part 51, is connected to the driving part 53 of the washing arm 52, and vertically moved as shown by the arrow A and rotated in the horizontal direction as shown by the arrow B by the driving part 53.

[0020]

Next, the operation of the spin-coating part 1 in the resist spreader of the embodiment of the present invention is explained. First, the spin chuck 11 is washed before spreading the photoresist on the semiconductor wafer. In the washing operation, first, the valve 30 installed in the pipe 31 of N_2 gas is opened by rotating the motor 13, and the N_2 gas is discharged to the upper side of the surface of the spin chuck 11 from the exhaust hole 11a of the spin chuck 11. With the discharge of the N_2 gas to the upper side of the surface of the spin chuck 11, the inflow of the washing solution such as acetone into the exhaust ports 11a and 12a, exhaust pipe 18, etc., which are exhaust systems of the vacuum chuck, is prevented when the spin chuck 11 is washed by the washing head part 51 which will be mentioned later.

[0021]

Next, a washing start instruction of the spin chuck 11 is given by the control part 54. With the washing start instruction, a signal is sent to the driving part 53 from the control part 54,

the driving part 53 is operated, the washing arm 52 is rotated in the horizontal direction (movement indicated by the arrow B), the washing head part 51 at the outside of the cup 15 of the spin-coating part 1 is moved to the upper side of the spin chuck 11, and the washing arm 52 is moved downward (movement shown by the arrow A) . If the downward movement of the above-mentioned washing arm 52 is started, a signal for opening the valve 56 of the pipe 55 for feeding acetone into the washing head part 51 is sent to the valve 56 from the control part 54, the valve 56 is opened, and the acetone starts to be jetted toward the surface of the spin chuck 11 from the jet ports 51d of the washing head part 51.

[0022]

The washing arm 52 is moved downward, and the downward movement of the washing arm 52 is stopped at the position where the brush 51a of the washing head part 51 contacts with the spin chuck 11. In this state, the surface of the rotating spin chuck 11 is washed with the acetone solution by the brush 51a. After washing for a prescribed time by the acetone solution and the brush 51a, a signal is sent to the driving part 53 from the control part 54, the driving part 53 is operated, and the washing arm 52 is moved upward (movement shown by the arrow A). If the upward movement of the washing arm 52 starts and the brush 51a is separated from the spin chuck 11, a signal is sent to the valves 56 and 58 from the control part 54, the valve 56 is closed, the valve 58 is opened, and N_2 is jetted from the jet ports 51d of the washing head part 51, so that the washing solution of the surface of the spin chuck 11 is dried, and dusts are blown off.

[0023]

When the washing arm 52 moves upward and arrives at a prescribe position, a signal is sent to the valve 58 from the control part 54, and the valve 58 is closed. Then, the washing arm 52 rotates horizontally (movement shown by the arrow B) and returns to the original position of the washing arm 52 at the outside of the cup 15 of the spin-coating part 1. Then, the valve 30 installed in the pipe 31 of N_2 gas is closed, and the rotation of the motor 13 is stopped. Also, in the washing process of the above-mentioned spin chuck 11, the valve 30 and the motor 13 have not been operated by the signal instruction from the control part 54, however the operation of the valve 30 and the operation of the motor 13 may also be operated by the signal instruction from the control part 54.

[0024]

After finishing the washing of the above-mentioned spin chuck 11, similarly to a conventional example, the semiconductor wafer is placed on the spin chuck 11 and vacuum-chucked, a nozzle (see Figure 3) for photoresist is moved to the upper side of the central

part of the semiconductor wafer, the photoresist is dropped on the semiconductor wafer, and the photoresist is spread by rotating the spin chuck 11.

[0025]

According to the resist spreader in which the above-mentioned automatic spin chuck washer 50 is installed, a periodical washing such as washing of the spin chuck 11 before spreading the photoresist on each prescribed quantity of semiconductor wafers (unit lot) on which the photoresist is spread is easy, so that the semiconductor wafer damage during spreading of the photoresist, which is caused by the inferiority of the vacuum chuck due to dusts of the spin chuck surface and photoresists attached to the spin chuck surface, can be lightened and the decrease of the manufacture yield of semiconductor devices due to the dust attachment in the spin chuck part to the back face of the semiconductor wafer can be reduced. Also, in the above-mentioned resist spreader, the operability of the resist spreader is improved, compared with the conventional washing work of the spin chuck 11 after removing the spin chuck 11 from the spin-coating part 1.

[0026]

Hereto, the present invention has been explained by the embodiment, however the present invention is not limited to this embodiment. For example, the brush installed in the washing head part has been a brush composed of fibers made of Teflon, however a brush composed of fibers made of resin such as nylon may be employed in accordance with the washing solution being used. Also, in the embodiment of the present invention, acetone has been used as the washing solution, however a photoresist solvent such as thinner may also be used as the washing solution. In addition, the operation sequence of the automatic spin chuck washer in washing of the spin chuck can be appropriately changed within the range of the technical concept of the present invention.

[0027]

Effects of the invention

As seen from the above explanation, in the resist spreader in which the automatic spin chuck washer of the present invention is installed, the operability decrease along with washing of the spin chuck for vacuum-chucking a semiconductor wafer can be suppressed. Also, if the resist spreader of the present invention is used in the manufacture of a semiconductor device, a periodical washing of the spin chuck is easy, and the damage of the semiconductor wafer due to the inferiority of the vacuum chuck is lightened. Also, the yield of the manufacture yield due to

the dust attachment in the spin chuck part to the back face of the semiconductor wafer can be reduced.

Brief description of the figures

Figure 1 is an outlined diagram showing a spin-coating part in the resist spreader of an embodiment of the present invention.

Figure 2 is an outlined diagram showing a washing head part of an automatic spin chuck washer in the resist spreader of the embodiment of the present invention. (a) is an outlined cross section showing a washing head part, and (b) is an outlined plan view showing the washing head part observed from the lower side.

Figure 3 is an outlined diagram showing a spin-coating part in a resist spreader of a conventional example.

Figure 4 is an outlined diagram showing a spin chuck of the spin-coating part in the resist spreader of the conventional example.

Explanation of symbols

1	Spin-coating part
10	Semiconductor wafer
11	Spin chuck
11a, 12a, 17a	Exhaust holes
11b, 11c	Vacuum chuck groove parts
12	Rotational shaft
13	Motor
14	Exhaust pump
15	Cup
16	Nozzle for photoresist
17	Vacuum chuck
18, 21	Exhaust pipes
19, 22, 30, 56, 58	Valves
20	Waste solution pipe
23, 31, 55, 57	Pipes
24	Sack back part
50	Automatic spin chuck washer
51	Washing head part
51a	Brush
51b	Jet part

51c	Pipe part
51d	Jet port
52	Washing arm part
53	Driving part
54	Control part

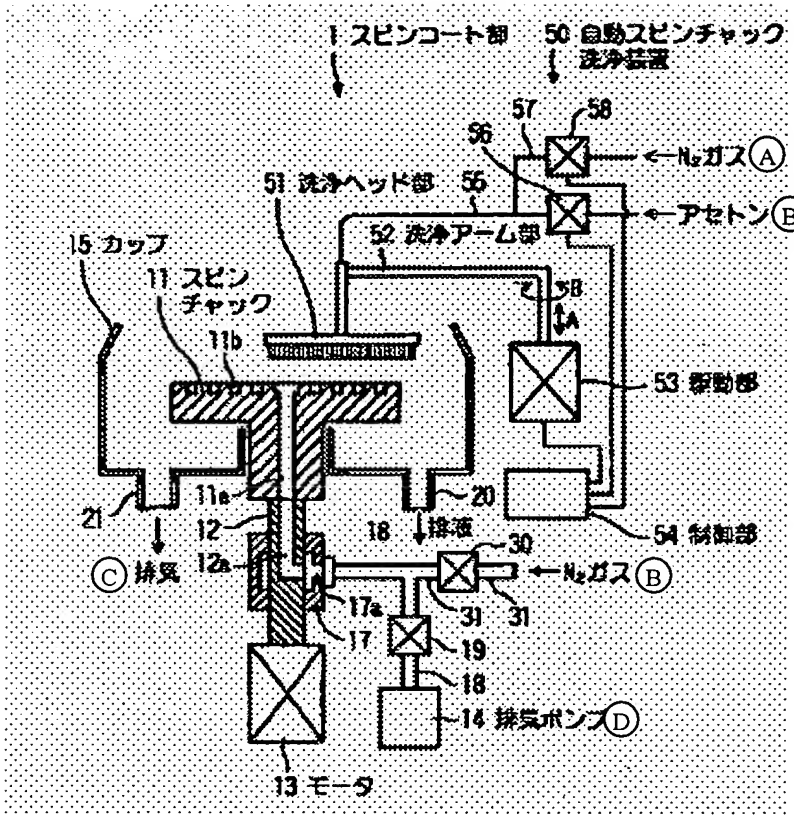

Figure 1

Key:

A	N_2 gas
B	Acetone
C	Exhaust gas
D	Discharge solution
1	Spin-coating part
11	Spin chuck
13	Motor
14	Exhaust pump
15	Cup
50	Automatic spin chuck washer
51	Washing head part
52	Washing arm part
53	Driving part
54	Control part

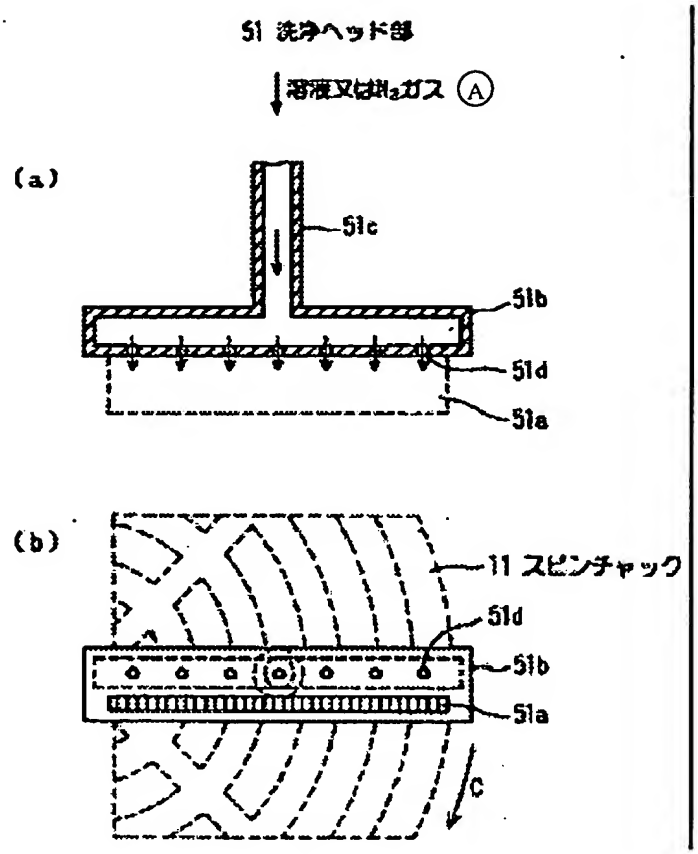

Figure 2

Key: A Solution or N_2 gas
11 Spin chuck
51 Washing head part

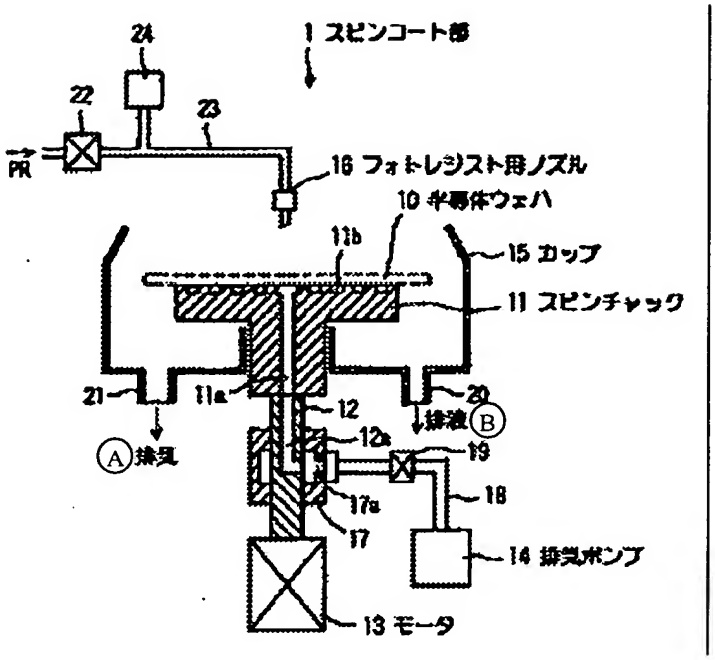

Figure 3

Key:

	A	Exhaust gas
	B	Discharge solution
	1	Spin-coating part
	10	Semiconductor wafer
	11	Spin chuck
	13	Motor
	14	Exhaust pump
	15	Cup
	16	Nozzle for photoresist

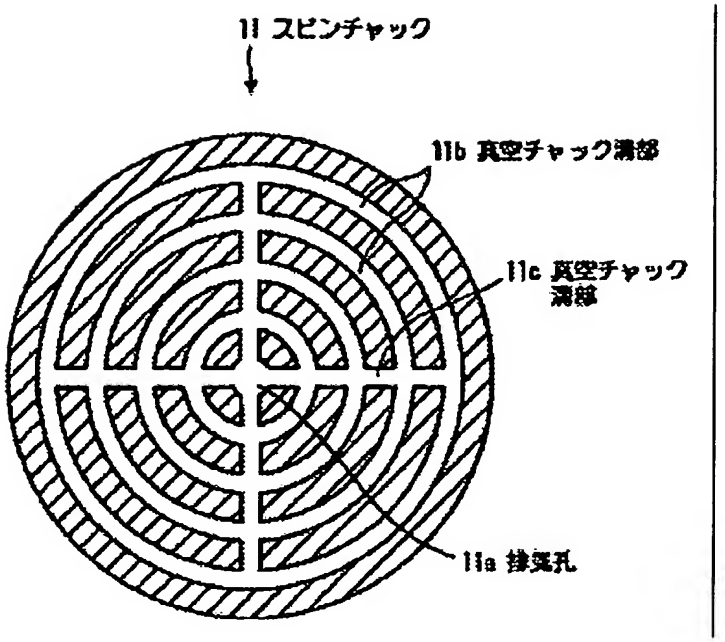

Figure 4

Key:
	11	Spin chuck
	11a	Exhaust hole
	11b	Vacuum chuck groove part
	11c	Vacuum chuck groove part